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American-Canadian Mortality Investigation, based on the experience of the United States and Canada during the years 1900 to 1915 inclusive, on policies issued from 1843 to 1914 inclusive. New York, The Actuarial Society of America, Volume I, 1918. Pp. 378. Volume II, 1919. Pp. 139.

The principal object of this investigation is perhaps best indicated by a brief résumé of its history. In August, 1911, a committee of the National Convention of Insurance Commissioners, in a report submitted to that body, suggested that the Actuarial Society should "turn its attention to the construction of new mortality tables covering the general experience of the companies among normal lives." The Actuarial Society of America was at that time still engaged on the Medico-Actuarial Mortality investigation and could not take up any other work until that investigation had been finished. In October, 1914, the Convention of Insurance Commissioners again renewed its request, and the next year the Actuarial Society, having in the meantime completed the other investigation, appointed a committee and authorized it to proceed with the desired investigation. Although the principal object of the investigation was the construction of the mortality table representing the experience on American insured lives, the opportunity was taken at the same time to construct a similar table for men resident in Canada at date of application. In order, also, that the experience included in each table should be homogeneous, the principal table was confined to the experience on American men. However, the experience on American and Canadian insured women was separately investigated and compared with the primary tables.

At this same time, also, the opportunity was taken to investigate the mortality experience on men by groups of states in the United States, and by groups of provinces in Canada, the experience on men analyzed by plans of insurance, on insurance changed or converted from term policies, or renewed under renewable term policies, and on insurance by amounts; and also to make an investigation of causes of death.

In the introduction to Volume I is given a complete description of the rules applied to insure homogeneity and of the methods adopted in carrying out this investigation, including the mechanical tabulation of the cards and the graduation of the resulting data. The following summary will give an idea of the extent of the data in the various sections of the experience:

	Deaths	Total Exposures	Ratio of Exposures to New Entrants
American men.....	\$436,345,200	\$26,003,321,900	11.64
Canadian men.....	29,400,800	2,743,665,100	8.08
American women.....	10,878,500	787,819,500	8.58
Canadian women.....	672,500	69,144,100	8.35

The predictions which had been made with regard to the probable result of the investigation were in the main confirmed, the rates of mortality in the ultimate part on the table based on the experience on American men agreeing substantially with those in the M. A. table. The following schedule shows the rates

of mortality at specimen ages and also the ratios of those rates to the corresponding rates given in the American experience table, in the United States life table for white males, and in the 0^m ⁽⁵⁾ table:

Age	Rate of Mortality	Ratio to American Exp.	Ratio to U. S. Males (White)	Ratio to 0 ^m (⁵)
25. ....	.00431	.53	.78	.63
35. ....	.00478	.53	.56	.58
45. ....	.00794	.71	.63	.67
55. ....	.01747	.94	.81	.84
65. ....	.04066	1.01	.93	.96
75. ....	.09194	.97	.99	.99
85. ....	.19707	.84	1.03	.96

The rates of mortality in the graduated table are shown in select form, the select rates running into the ultimate at the end of five years. This procedure is justified by the figures contained in the following schedule:

Insurance Year	Ratio of Actual to Expected—Per cent
1st.	63.4
2nd.	84.1
3rd.	87.4
4th.	89.6
5th.	91.5
6th.	98.6
7th.	101.2
8th.	97.7
9th.	104.4
10th.	96.4
11th and subsequent.	100.0

A comparison is given of the net premium rates and reserves according to the new table with those according to the American experience table, and indicates that for some plans and ages the new basis would show a lower reserve than the old, whereas on others it would show a higher. The statement is made that a valuation of one of the largest and oldest life insurance companies showed an aggregate reserve on the basis of the new table of 2 per cent greater than that on the American experience table, both at 3 per cent interest.

An interesting feature in connection with the graduation of both the American men table and the Canadian men table is that Makeham's second modification of Gompertz' formula was adopted, it having been found impossible to fit satisfactorily Makeham's first modification to the data. The graduated rates of mortality on Canadian men are higher than on American men at ages under twenty-seven and above eighty-one, but between those ages the Canadian men showed a lower mortality, falling as low as 84 per cent of the American man rate at age fifty-five.

The experience of insurance on the lives of women in the United States and Canada showed similar results when compared with the experience on men in the respective countries, the mortality in each case being higher on women during the first five insurance years and at ages under forty in the ultimate table, and

lower at ages of forty and over in the ultimate table. On American women the aggregate death losses were 94.4 per cent of the expected according to the American men table, and in the experience on Canadian women, 97.9 per cent of the expected according to the Canadian men table.

In Volume II the first subject taken up is mortality according to plan. A summary of the results is given in the following schedule:

	Ratio Actual to Expected—Per cent
Ordinary life.....	102.2
19- and 20-payment life.....	94.3
19- and 20-year endowment.....	95.5
10-year term.....	102.2

It is interesting to note that the mortality experience on the 19- and 20-payment life policies is slightly better than on the 19- and 20-year endowment policies; this fact is possibly due to the offering of endowment policies on lives not considered eligible on the life plan.

The experience on 10-year term policies changed or converted during the original period was favorable, aggregating 88.8 per cent of the expected according to the general table. On those renewed or converted at the end of the period, on the other hand, the actual amounted to 108.4 per cent of the expected.

The analysis of mortality according to the habitat in the United States shows very interesting results, the mortality in the various sections ranging from 88.7 per cent of the expected in the wheat growing district of the Northwest to 124 per cent in a group of states bordering on the Gulf of Mexico. In Canada the results of the same kind of analysis were similar in so far as the location of best mortality is concerned, the ratio in the prairie provinces being 87.2 per cent of the general rate; but in this case the unfavorable mortality showing came from the provinces in Quebec, and is estimated to have been due to racial mortality. An investigation of the mortality among women in the Province of Quebec, although based on scanty material, indicated, so far as it went, a mortality 25 per cent above that among Canadian women as a whole.

In the analysis of the causes of death, the deaths from each cause are shown as percentages of total deaths and also as a ratio per \$10,000 exposed to risk and are arranged in subdivisions according to duration and age at death. A comparison of the figures for the United States and Canada showed markedly greater death rates among American than among Canadian men from cerebral hemorrhage and apoplexy, organic diseases of the heart, diabetes, nephritis and Bright's disease, and a slightly greater death rate in the case of pneumonia. In the cases of accident, the Canadian death rates were higher.

The data pertaining to the investigation of mortality under policies for large amounts were not very extensive, but so far as the data went the indications pointed to a mortality in excess of the normal, the ratio for all policies of \$50,000 or more being 116.7 per cent for all ages at entry and all durations combined; for aggregate amounts of \$100,000 or over, this percentage was 131.2 per cent.

In that part of the work which is represented by Volume I, the committee

of the Actuarial Society had the coöperation of a committee of Insurance Department actuaries appointed by the National Convention of Insurance Commissioners, and in the entire work it had the coöperation of a committee appointed by the American Institute of Actuaries, at the invitation of the Actuarial Society.

ROBERT HENDERSON.

An Index Number for State School Systems, by Leonard P. Ayres. New York, Russell Sage Foundation, 1920. Pp. 70.

Great interest has recently been aroused in educational circles throughout the country by the appearance of Dr. Ayres's book. Coming as it does from the pen of this expert on the subject of educational statistics, it presents in an authoritative manner the results of a careful study of statistical information with regard to education. The author computes for the several state systems an index number based upon ten sets of educational data. The data included are the following:

1. Per cent of school population attending school daily.
2. Average days attended by each child of school age.
3. Average number of days schools were kept open.
4. Per cent that high school attendance was of total attendance.
5. Per cent that boys were of girls in high schools.
6. Average annual expenditure per child attending.
7. Average annual expenditure per child of school age.
8. Average annual expenditure per teacher employed.
9. Expenditure per pupil for purposes other than teachers' salaries.
10. Expenditure per teacher for salaries.

It will be noted that the first five of these items refer to attendance, and the last five to financial matters. The question naturally arises as to the degree to which these items indicate the efficiency of educational procedure in the several states. Are there not other items, such as the achievements of pupils in standardized tests, the courses of study, etc., which would indicate more reliably the efficiency of the educational process? Dr. Ayres answers questions such as this in the following manner:

"If some great national agency were to undertake a survey of each of the forty-eight state school systems, it would surely report on many phases of their work not included in the items of the index. Among such phases would be the legal basis of the system, its organization, professional leadership and supervision, business management, course of study, teaching staff, plant and equipment, and the results of standard tests of classroom work.

"These elements, and others like them, are not directly included in the index, although some of them are crudely measured by the several items for financial expenditure. The sad fact is that, if there were available such information as surveys gather on most of the subjects suggested above, it would be still impossible to state the results in terms that could be included in an index number. The reason for this is that there is as yet little exact knowledge about education.